

CLAIMS

What is claimed is:

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1. A method of filtering upstream scheduling messages in a data communication system, wherein the data communication system includes a headend and at least one subscriber unit, and wherein the communication system uses a plurality of upstream scheduling messages and a selected modulation scheme to transport data, and wherein the system has an upstream and a downstream transmission path, and wherein an upstream scheduling message includes a plurality of information elements (IEs), the method comprising the steps of:
 - (a) obtaining a scheduling message from the headend;
 - (b) filtering the scheduling message to identify a plurality of IEs that are associated and that correspond to a selected subscriber unit; and
 - (c) storing an information set based upon the plurality of IEs obtained in step (b) into a filtered scheduling message.
 2. The method of filtering upstream scheduling messages as set forth in Claim 1, wherein the headend includes a cable modem termination system (CMTS).
 3. The method of filtering upstream scheduling messages as set forth in Claim 1, wherein the subscriber unit comprises a cable modem.
 4. The method of filtering upstream scheduling messages as set forth in Claim 1, wherein the information set includes a transmit time.
 5. The method of filtering upstream scheduling messages as set forth in Claim 1, wherein the information set includes a transmit time and a transmit duration.
 6. The method of filtering upstream scheduling messages as set forth in Claim 1, wherein the information set includes a transmit time, a transmit duration and an Interval Usage Code (IUC).

7. The method of filtering upstream scheduling messages as set forth in Claim 1, wherein the filtering step (b) is implemented using software instructions executed by a processing device.
8. The method of filtering upstream scheduling messages as set forth in Claim 1, wherein the filtering step (b) is implemented in firmware.
9. The method of filtering upstream scheduling messages as set forth in Claim 1, wherein the filtering step (b) includes the following sub-steps:
 - (1) filtering the scheduling message to identify well-known addresses;
and
 - (2) filtering the scheduling message to identify IEs that are associated with the selected subscriber unit; and wherein the sub-step of filtering the scheduling message for well-known addresses is implemented in software, and wherein the sub-step of filtering for IEs associated with the selected subscriber unit is implemented in hardware.
10. The method of filtering upstream scheduling messages as set forth in Claim 9, wherein the filtering sub-step (2) includes the following sub-steps:
 - a) writing a service identifier (SID) of a selected IE into a hardware input register, thereby triggering an automatic comparison of the hardware input register contents to a hardware look-up table;
 - b) storing the resulting comparison value into a hardware result register; and
 - c) determining whether a specified bit in the hardware result register is a logical one, and if the specified bit is a logical one, determining that the selected IE represents a unicast address that is associated with and that corresponds to the selected subscriber unit.

11. The method of filtering upstream scheduling messages as set forth in Claim 1, wherein the step (a) of obtaining a scheduling message includes the step of performing an DMA/CRC operation on the scheduling message to align the scheduling message on selected D-word boundaries.
12. The method of filtering upstream scheduling messages as set forth in Claim 1, wherein the scheduling message includes a MAP message further including a plurality of IEs.
13. The method of filtering upstream scheduling messages as set forth in Claim 12, wherein the scheduling message filtered during step (b) includes a filtered MAP message including a plurality of data fields.
14. The method of filtering upstream scheduling messages as set forth in Claim 13, wherein an IE of the MAP message includes a service identifier (SID), an Interval Usage Code (IUC), a Minislot offset and a Minislot length value.
15. The method of filtering upstream scheduling messages as set forth in Claim 14, wherein the MAP message further includes at least one Real IE and at least one Null IE.
16. The method of filtering upstream scheduling messages as set forth in Claim 14, wherein the MAP message further includes at least one Real IE, at least one Null IE and at least one Acknowledgement IE.
17. The method of filtering upstream scheduling messages as set forth in Claim 16, wherein the step (c) of storing an information set includes the following sub-steps:
 - (1) before encountering a Null IE, storing the information using a first process;
 - (2) when encountering the Null IE, storing the information using a second process; and
 - (3) after encountering the Null IE, storing the information using a third process.

18. The method of filtering upstream scheduling messages as set forth in Claim 17, wherein the first process comprises Real IE processing.
19. The method of filtering upstream scheduling messages as set forth in Claim 18, wherein Real IE processing process comprises the following sub-steps:
- a) storing the SID in a 16-bit SID field;
 - b) storing the IUC in an 8-bit IUC field;
 - 5 c) storing the Minislot offset in a 16-bit Minislot offset field;
 - d) calculating a Minislot length; and
 - e) storing the Minislot length calculated in sub-step (d) in a 16-bit Minislot length field.
20. The method of filtering upstream scheduling messages as set forth in Claim 17, wherein the second process comprises Null IE processing.
21. The method of filtering upstream scheduling messages as set forth in Claim 20, wherein Null IE processing comprises the following sub-steps:
- a) storing a value of zero in a 16-bit SID field;
 - b) storing a value of 7 in an 8-bit IUC field;
 - 5 c) storing the Minislot offset in a 16-bit Minislot offset field; and
 - d) storing a value of zero in a 16-bit Minislot length field.
22. The method of filtering upstream scheduling messages as set forth in Claim 17, wherein the third process comprises Acknowledgment IE processing.
23. The method of filtering upstream scheduling messages as set forth in Claim 22, wherein Acknowledgement IE processing comprises the following sub-steps:
- a) storing the SID in a 16-bit SID field;
 - b) storing the IUC in an 8-bit IUC field;
 - 5 c) storing the Minislot offset in a 16-bit Minislot offset field; and
 - d) storing a value of zero in a 16-bit Minislot length field.

24. An upstream scheduling message filter adapted for use in a data communication system, wherein the data communication system includes a headend and at least one subscriber unit, and wherein the communication system transports data using a plurality of upstream scheduling messages and a modulation scheme having an upstream and a downstream transmission path, and wherein an upstream scheduling message includes a plurality of information elements (IEs), the filter comprising:
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- (a) a message scheduling device, adapted to obtain a scheduling message from a CMTS;
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- (b) a filtering device, coupled and responsive to the message scheduling device, adapted to filter the scheduling message obtained by the message scheduling device, wherein the filtering device is capable of generating a plurality of IEs that are associated with a selected cable modem; and
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- (c) a storage device, coupled and responsive to the filtering device, adapted to store an information set based upon the plurality of IEs generated by the filtering device.

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25. An upstream scheduling message filter adapted for use in a data communication system, wherein the data communication system includes a headend and at least one subscriber unit, and wherein the communication system transports data using a plurality of upstream scheduling messages and a modulation scheme having an upstream and a downstream transmission path, and wherein an upstream scheduling message includes a plurality of information elements (IEs), the apparatus comprising:
- (a) means for receiving a scheduling message from a headend;
 - (b) means, coupled to the scheduling message receiving means, for filtering the scheduling message for a plurality of IEs associated with and corresponding to a selected subscriber unit; and
 - (c) means, coupled and responsive to the filtering means, for storing an information set based upon the plurality of IEs obtained by the filtering means.
26. The apparatus as set forth in Claim 25, wherein the headend includes a cable modem termination system (CMTS).
27. The apparatus as set forth in Claim 25, wherein the subscriber unit comprises a cable modem.
28. The apparatus as set forth in Claim 25, wherein the information set includes a transmit time, a transmit duration and an Interval Usage Code (IUC).
29. The apparatus as set forth in Claim 25, wherein the receiving means includes means for performing an DMA/CRC operation on the scheduling message to align the scheduling message on selected D-word boundaries.
30. The apparatus as set forth in Claim 25, wherein the scheduling message includes a MAP message further including a plurality of IEs.

31. A cable modem capable of filtering upstream scheduling messages in a data communication system, wherein the cable modem is coupled to a cable modem termination system (CMTS), and wherein the data communication system transports data using a plurality of upstream scheduling messages and a modulation scheme including an upstream and a downstream transmission path, and wherein an upstream scheduling message includes a plurality of information elements (IEs), the cable modem comprising:

- (a) a message scheduling device, adapted to obtain a scheduling message from a CMTS;
- (b) a filtering device, coupled and responsive to the message scheduling device, adapted to filter the scheduling message obtained by the message scheduling device, wherein the filtering device is capable of generating a plurality of IEs that are associated with a selected cable modem; and
- (c) a storage device, coupled and responsive to the filtering device, adapted to store an information set based upon the plurality of IEs generated by the filtering device.

32. A communication device capable of filtering upstream scheduling messages in a data communication system, wherein the communication device is coupled to a cable modem termination system (CMTS), and wherein the data communication system transports data using a plurality of upstream scheduling messages and a modulation scheme including an upstream and a downstream transmission path, and wherein an upstream scheduling message includes a plurality of information elements (IEs), the communication device comprising:
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- (a) means for obtaining a scheduling message from a CMTS;
- (b) means, coupled and responsive to the scheduling message obtaining means, for filtering the scheduling message obtained by the scheduling message obtaining means; wherein the filtering means is capable of generating a plurality of IEs that are associated with a selected subscriber unit; and
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- (c) means, coupled and responsive to the filtering means, for storing an information set based upon the plurality of IEs generated by the filtering means.
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33. The communication device as set forth in Claim 32, wherein the communication device comprises a cable modem.
34. The communication device as set forth in Claim 32, wherein the information set includes a transmit time, a transmit duration and an Interval Usage Code (IUC).
35. The communication device as set forth in Claim 32, wherein the obtaining means includes means for performing an DMA/CRC operation on the scheduling message to align the scheduling message on selected D-word boundaries.

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36. A computer program executable on a computing device, wherein the program is capable of flexibly filtering upstream scheduling messages in a data communication system, comprising:
- (a) a first set of instructions for obtaining a scheduling message;
 - (b) a second set of instructions for filtering the scheduling message to identify a plurality of IEs that are associated with and that correspond to a selected communication device; and
 - (c) a third set of instructions for storing an information set based upon the plurality of IEs identified by the second set of instructions.
37. The computer program as set forth in Claim 36, wherein the communication device is a cable modem.
38. The computer program as set forth in Claim 37, wherein the communication device is a DSL modem.

39. A method of filtering upstream scheduling messages in a data communication system, wherein the data communication system includes a headend and at least one subscriber unit, and wherein the communication system uses a plurality of upstream scheduling messages and a selected modulation scheme to transport data, and wherein the system has an upstream and a downstream transmission path, and wherein an upstream scheduling message includes a plurality of information elements (IEs), the method comprising the following steps:

- (a) a step for obtaining a scheduling message from the headend;
- (b) a step for filtering the scheduling message obtained in step (a) to identify a plurality of IEs that are associated and that correspond to a selected subscriber unit; and
- (c) a step for storing an information set based upon the plurality of IEs obtained in step (b) into a filtered scheduling message.

40. A communication device capable of transmitting a scheduling message to a subscriber unit in a data communication system, wherein the data communication system transports data using a plurality of upstream scheduling messages and a modulation scheme including an upstream and a downstream transmission path, and wherein an upstream scheduling message includes a plurality of information elements (IEs), the subscriber unit comprising:

- (a) means for obtaining a scheduling message from the communication device;
- (b) means, coupled and responsive to the scheduling message obtaining means, for filtering the scheduling message obtained by the scheduling message obtaining means; wherein the filtering means is capable of generating a plurality of IEs that are associated with a selected subscriber unit; and
- (c) means, coupled and responsive to the filtering means, for storing an information set based upon the plurality of IEs generated by the filtering means.

41. The communication device as set forth in Claim 40, wherein the communication device comprises a CMTS.

42. The communication device as set forth in Claim 40, wherein the communication device comprises a WAN.

43. The communication device as set forth in Claim 40, wherein the subscriber unit comprises a cable modem.

44. The communication device as set forth in Claim 40, wherein the information set includes a transmit time, a transmit duration and an Interval Usage Code (IUC).
45. The communication device as set forth in Claim 40, wherein the obtaining means includes means for performing an DMA/CRC operation on the scheduling message to align the scheduling message on selected D-word boundaries.
46. A CMTS capable of transmitting a scheduling message to a cable modem in a data communication system, wherein the data communication system transports data using a plurality of upstream scheduling messages and a modulation scheme including an upstream and a downstream transmission path, and wherein an upstream scheduling message includes a plurality of information elements (IEs), the cable modem comprising:
- (a) a message scheduling device, adapted to obtain a scheduling message from the CMTS;
 - (b) a filtering device, coupled and responsive to the message scheduling device, adapted to filter the scheduling message obtained by the message scheduling device, wherein the filtering device is capable of generating a plurality of IEs that are associated with a selected cable modem; and
 - (c) a storage device, coupled and responsive to the filtering device, adapted to store an information set based upon the plurality of IEs generated by the filtering device